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BCG Vaccination of Guinea Pigs and Superinfection in Rabbits.—The authors recommend that the term "superinfection" be limited to animals in which the bacilli of the first infection are still living and the virulence of the bacilli of the second infection is of the same order as that of the first infection. They use the term "reinfection" for those instances in which infection takes place after the bacilli of the first infection have died out. The authors attempted to reproduce reinfection in rabbits' lungs as it occurs in human beings. For this purpose they infected a series of rabbits with varying numbers of viable virulent bacilli intratracheally. After the lapse of a definite interval these rabbits, together with uninfected controls, were inoculated with varying numbers of the same virulent culture. They failed in all instances to reproduce in the lungs of rabbits a disease resembling the chronic type of tuberculosis occurring in man. For in no instance could they produce in rabbits or other animals a retrogressive pulmonary disease with virulent bacilli. They therefore believe that reinfection or superinfection experiments in laboratory animals can throw little light on the pathogenesis of the disease in man. They then resorted to vaccination experiments with BCG in guinea pigs. With large infecting doses there was little difference between the vaccinated and the control animals. With small infecting doses the vaccinated animals showed less enlargement of the draining lymph nodes and, at times, these became palpable. Tuberculin sensitivity failed to reach as high a level as in the control animals. This seemingly anomalous behavior of the vaccinated animals toward allergy, the authors consider as different from the response of animals to antibody production. For it is well known that on reinjection of an antigen the antibody production is more rapid than on first injection. The average survival time of the vaccinated animals was significantly longer than that of the normals. The number of bacilli cultured from the lungs of the vaccinated was also significantly less. In an occasional animal the immunity is complete to 5 to 30 bacilli. But usually the immunity conferred on guinea pigs by BCG vaccination is of low order. They conclude that BCG vaccination in guinea pigs retards rather than suppresses the growth of tubercle bacilli and thus favors the development of a more chronic disease.—*The Vaccination of Guinea Pigs with Living BCG together with Observations on Tuberculous Superinfection in Rabbits, H. Schwabacher & G. S. Wilson, J. Path. & Bact., May, 1938, xlvi, 535.—(M. B. L.)*

Immunization of Guinea Pigs with Killed Avian Tubercle Bacilli.—Ten guinea pigs were given four injections at five-day intervals of 1 mg. each of heat-killed tubercle bacilli of an avian strain suspended in physiological salt solution.

The first injection was an intracardiac inoculation, the other two were subcutaneous. A month later the animals received 2 mg. of living avian bacilli of the same strain by intracardiac inoculation. Untreated guinea pigs given the same dose of living bacilli died within a month of the infection. Among the treated guinea pigs 2 died the day following the infection with the living bacilli, both showing a marked generalized congestion. A third animal died in three months, a fourth in six months, both of intercurrent infections. Both were entirely free of any lesions due to the inoculation of avian tubercle bacilli. The remaining guinea pigs were entirely well at the end of eight months. A second series of experiments was made in which 14 guinea pigs treated with heat-killed avian tubercle bacilli in the same manner as in the former experiment were given an intracardiac inoculation of 3 mg. of the same strain. Six control guinea pigs were given the same dosage. Nine of the treated guinea pigs died within twenty-four hours, presenting at autopsy a marked congestion of the spleen, liver, lungs, kidneys and adrenals. Numerous tubercle bacilli were found in the spleen, liver and lungs. The 5 remaining animals died within four to forty-three days after the infection, showing at autopsy the same characteristic generalized congestion. All the control animals died of typical infections with avian tubercle bacilli. In a third series of experiments 20 guinea pigs were given three injections, in the same manner as in the former two experiments, of heat-killed avian tubercle bacilli but of a different strain. Three of the animals died following the injections. The liver and spleen were normal. The remaining 17 guinea pigs together with 8 control guinea pigs were given an intracardiac inoculation of 1 mg. of the same strain. All the animals died including the control animals. Their deaths could probably be explained by the fact that this strain was too pathogenic for the immunizing dose which was too weak to protect the animals.—*Sensibilisation et prémunition de cobayes au moyen de bacilles tuberculeux aviaires morts, vis-a-vis de bacilles homologues vivants, F. van Deinse & R. Schwartz, Compt. rend. Soc. de biol., March 12, 1938, cxxvii, 856.*—(*M. T. W.*)

Immunization with Old Tuberculin.—Old Tuberculin, made on synthetic medium, when administered subcutaneously in large amount (42 cc.) before and (88 cc.) during experimental tuberculous infection in guinea pigs, conferred no demonstrable immunity. The view that the immunity persisting after desensitization by tuberculin is a result of the treatment is, therefore, not a valid one. The lungs and spleens, on careful examination, showed less caseation than in control tuberculous guinea pigs, either untreated or treated similarly with concentrated medium. The tuberculous guinea pigs treated with the Old Tuberculin gave no Koch phenomenon reactions whereas those in the two control groups gave markedly positive reactions.—*Immunizing Effect of Old Tuberculin on Experimental Tuberculous Infection, R. H. Follis, Jr., Proc. Soc. Exper. Biol. & Med., October, 1938, xxxix, 45.*—(*F. B. S.*)

Sensitization with Modified PPD.—PPD was prepared with the following modifications from the standard procedure: (*1*) Wong's modification of Henley and LeDuc's synthetic medium was used and the H37 strain of tubercle bacilli was grown for four weeks; (*2*) glycerin was not added to the tuberculin before concentration on the water bath; and (*3*) the tuberculoprotein was precipitated with trichloracetic acid directly after concentration, without previous washing on the ultrafilter. This preparation, when injected intravenously (5 to 10 mg.) into 24 guinea pigs previously sensitized by three injections (30 mg.) of it, produced anaphylactic shock or death in 11. Skin sensitization did not occur. Precipitins could not be elicited in rabbits but complement fixation occurred with 1:1,000 dilution of antigen and serum diluted 1:5. A moderate degree of shock was given in 3 guinea pigs passively sensitized, but antibody could not be demonstrated serologically. Tuberculopolysaccharide produced no shock.—*Sensitization of Guinea Pigs by a Modified Form of Seibert's Tuberculoprotein Derivative, S. C. Wong & I. K. C. Chu, Proc. Soc. Exper. Biol. & Med., December, 1938, xxxix, 423.*—(*F. B. S.*)

Tuberculin Reactions in Avian Infections.—Chickens, rabbits and guinea pigs were inoculated with six strains of avian tubercle bacilli recovered from tuberculous chickens, and one strain of human tubercle bacilli, as a control in doses varying from 1.0 to 0.000,001 mg. The animals all showed classical reactions to inoculations with avian strains of tubercle bacilli. The animals were tested with avian tuberculin to determine the average duration of the antiallergic period, the intensity and the evolution of these reactions. With the chickens the tuberculin response was in proportion to the quantity of bacilli inoculated. In chickens inoculated with very weak doses, the tuberculin response was

doubtful or absent. In general it could be stated that from the tenth to the twelfth week following the inoculation there was an attenuation, followed by a disappearance of the tuberculin reaction. In the rabbit, the same type of reaction was observed. In the guinea pig the tuberculin reaction was more regular and seemed to be more stable. It was not attenuated in certain of the animals twenty weeks after the inoculation. —*Caractéres et évolution des réactions tuberculiniques aux cours de l'infection expérimentale par le bacille tuberculeux aviaire, H. Bonnet, S. Thieffry & M. Montefiore, Compt. rend. Soc. de biol., June 18, 1938, cxxviii, 585.*—(*M. T. W.*)

B. coli Vaccination against Tuberculosis.—In view of the fact that the tuberculous organism is hypersensitive not only to the tubercle bacillus and its products but also to other bacterial proteins, especially that of the colon bacillus, Nagel, working in Selter's laboratory, made an extended study of the effects of vaccination with colon bacillus on the course of tuberculous primary infections and reinfections in guinea pigs. An attempt to desensitize guinea pigs that had been made allergic by a tubercle bacillus of low virulence, by treatment with the colon vaccine, was without success. Treatment of normal guinea pigs with colon bacillus vaccine lowered their resistance to tuberculosis to such an extent that even tubercle bacilli of low virulence gave rise to progressive tuberculosis. On the other hand guinea pigs immunized with a tubercle bacillus of low virulence, a procedure which frequently gives rise to complete protection against minimal superinfecting doses, when treated with the colon bacillus vaccines, lost the immunity afforded them by the immunization and succumbed with extensive caseous lesions on superinfection. The author attributes the deleterious effect of the treatment to a heightened allergic irritability produced by treatment with colon bacillus vaccine in the allergic animals.—*Beeinflussung der tuberkulösen Erst-und Superinfektion beim Meerschweinchen durch Behandlung mit Coli-Impfstoff, A. Nagel, Ztschr. f. Immunitätsforsch., October, 1938, xciv, 87.*—(*M. B. L.*)

Vaccination of Mice against Tuberculosis.—These studies were undertaken to find out whether mice could be used to measure the immunizing power of various vaccines against tuberculosis. In attempting to assess different degrees of immunity by the animal inoculation method it is important to use a sufficient number of animals, for example, to detect a 10 per cent difference something like 500 animals are required to obtain a reliable result. Schwabacher and Wilson previously showed the reaction of mice to doses of mammalian tubercle bacilli ranging from 100 to 100 million, the main effect of differences in dosage being to alter survival time. Mice inoculated with large doses usually die in a few weeks, while with small doses they live several months. In earlier experiments a test dose of a million organisms was selected to set up a mild but slowly progressive disease such as might possibly be controlled by prophylactic immunization. However, it was not until a dose of 100 million organisms was reached that significant differences between vaccinated and control groups were noted. Even then these differences were only in survival time. Several experiments were run: in I to IV a living freshly prepared BCG emulsion was used, in V virulent human tubercle bacilli killed by heating at 66°C. for ninety minutes in a water bath. In VI a similar vaccine was prepared by autoclaving the organisms at one and one-half atmospheres for twenty-five minutes. Standardization was by the opacity method of Wilson and Schwabacher. The animals to be immunized received, either subcutaneously or intravenously, 2 to 20 immunizing doses, at intervals of three to seven days. Two to four weeks after the last they were inoculated intravenously, along with controls, with living virulent human bacilli of the same strain. All except 4 who were killed after 452 days were observed until death and careful necropsies done on each, all organs, especially the lungs, being searched and films from lungs, liver, spleen and kidneys stained by Ziehl-Neelsen method. The lungs were so cultured as to arrive at a quantitative estimate of living tubercle bacilli present. Only animals showing macroscopical lesions in the lungs containing acid-fast bacilli were considered to have died of tuberculosis, positive cultures alone being ignored. With the exception of the 4 mentioned, every animal in both groups died during observation. In general those in experiments III, IV and V, injected with 100 million virulent bacilli, had massive opaque caseous lesions in the lungs, with discrete and confluent areas, and the spleens were usually enlarged. Those in I, II and V, with smaller infecting doses, had typical tubercles in the lungs or opaque areas with crenated edges and a central dark spot, usually without enlarged spleens. The average survival time is recorded together with the standard deviation. A value of 2 is unlikely by chance alone oftener

than once in 22 experiments and of 3 only once in 370. Therefore, values of 3 or more strongly suggest a real difference in behavior due to changed immunological state. With this in mind, it is noted that the results appeared to be determined to some extent by dosage. With BCG significant differences were not noted when less than 20 million organisms were given and sharp differences between vaccinated and controls only when 100 million organisms were given. With killed bacilli a total dosage of under 40 million failed to yield significant results and then only when an infecting dose of 100 million bacilli was given. There seemed to be little difference in the protecting power of the two vaccines (BCG and killed bacilli) and this, together with the necessity of a high total dosage, suggests that BCG does not multiply appreciably in the mouse. As for the degree of bacillary invasion of the lung, differences even in the same group were so great that no statistical comparisons between vaccinated and control groups were made. *Summary and Conclusions:* (*1*) Six experiments on a total of 667 mice are recorded in the attempt to assess the protective value of subcutaneous or intravenous vaccination with living BCG in heat-killed tubercle bacilli against subsequent intravenous inoculation with virulent human tubercle bacilli. (*2*) The size of the vaccinating doses varied from 100,000 to 100 million bacilli and the number of doses from 2 to 20. The interval between doses was usually three to seven days. The test dose of infecting bacilli was given two to four weeks after the last inoculation of vaccine and varied from 1 to 100 million bacilli. (*3*) After inoculation the animals were observed until death. At postmortem the extent of macroscopical tuberculosis was determined and very complete microscopical and cultural examination of preparations of the lungs and other organs carried out. Only animals showing macroscopical lung lesions containing acid-fast bacilli were regarded as having died of tuberculosis. (*4*) With the exception of 4 animals in one experiment, all the mice in both immunized and nonimmunized groups died. (*5*) Postmortem examination failed to reveal any clear difference between the extent and severity of the lung lesions in the vaccinated and control groups. (*6*) The average survival time of the vaccinated animals in some experiments was very much longer than that of the control animals. (*7*) A statistically significant difference was not obtained in any experiment in which the total dose of vaccine was less than 20 million bacilli or in which the infecting dose of bacilli was relatively small (1 to 10 million). (*8*) The most favorable results were obtained in experiments in which the total vaccinating dosage was 20 million or under and the infecting dose 100 million. Under these conditions the observed difference exceeded its standard error by 3 or more times suggesting a significant increase in resistance. (*9*) The last conclusions derive support from the degree of bacillary lung invasion . . . usually 7 to 90 times greater in the control. (*10*) No appreciable difference was noted between the immunizing power of living BCG and of heat-killed human bacilli. With both vaccines approximately the same dosage appeared to be necessary . . . suggesting that BCG does not multiply appreciably in the mouse. (*11*) Mice may prove very useful in the preliminary assessment of the value of vaccines, being cheap and available in large numbers. (*12*) To detect small variations in resistance a large infecting dose appears more suitable than a small.— *Vaccination of Mice against Tuberculosis with Killed Cultures and with Living BCG, H. Schwabacher & G. S. Wilson, Tubercle, August, 1937, xviii, 492.*—(*A. P.*)

Sensitization with Heat-Killed Tubercle Bacilli.—Previous investigations have shown that rabbits thoroughly immunized with heat-killed tubercle bacilli acquire effective protection against infection fatal to unprepared rabbits. This method of protecting rabbits affords an unique opportunity of studying the relationship of sensitization and antibodies to immunity against tuberculosis as the progress of immunization is not modified by a living microörganism which may multiply in the body; also to determine if heat-killed tubercle bacilli can be used to protect human beings against tuberculosis. In the present article the conditions that modify sensitization and antibody production are studied and how these changes affect the local lesion produced by killed tubercle bacilli. Also the relation of sensitization and antibody formation to immunity is investigated. The plan of the main experiment was to inject a constant amount of heat-killed tubercle bacilli into the skin of rabbits at weekly intervals and observe the skin reactions, recent and old, two days later. These intracutaneous reactions served both to sensitize the animals and to measure the progress of sensitization. The dose was 0.2 mg. of dead bacilli which amount rarely caused suppuration. Old Tuberculin was also used to determine the amount of sensitization present. The fol-

lowing points are among those reported on: the measurement of the sensitization with tuberculin and its variation in progress (also compared with the sensitization induced by BCG), the fate and duration of the skin lesions produced by the dead bacilli, the progress of sensitization with cutaneous and subcutaneous injection of the antigen with both undivided and divided doses, the progress of sensitization with intravenous injection of the heat-killed tubercle bacilli, the production of antibodies (tuberculofixation) under various conditions and finally the relation of sensitization and titre of antibody before and during infection of the rabbits with virulent bovine tubercle bacilli. The authors' summary and conclusions follow: Rabbits (and human beings) differ widely in the rapidity with which they undergo sensitization with heat-killed tubercle bacilli, but after repeated injections all animals become sensitized. Intracutaneous injection of a small quantity of heat-killed tubercle bacilli into a previously normal animal produces a nodule which persists from eight to twelve weeks; the same injection into well sensitized animals produces a lesion which ulcerates within from one to three weeks and is completely healed after about five weeks. Complete healing is functional evidence of the disappearance of the antigen. Intracutaneous injection of heat-killed tubercle bacilli induces more rapid sensitization than subcutaneous or intravenous injection, but after repeated injections the difference disappears. Increasing quantities of heat-killed tubercle bacilli or the same quantity divided into several simultaneous injections accelerates sensitization. The rapidity of antibody formation measured by complement fixation varies in different rabbits under the same conditions but complement fixation is always demonstrable after repeated injections of heat-killed tubercle bacilli. Antibody formation is more rapid and reaches higher titres with intravenous than with intracutaneous or with subcutaneous injections. It is accelerated by division of the injected antigen into multiple simultaneous injections. Small quantities of BCG induce rapid sensitization and more abundant antibody formation measured by complement fixation than heat-killed tubercle bacilli, but with repeated injections the difference disappears. Animals that are sensitized and immunized (allergic) before infection are in most instances more resistant to infection than previously normal animals, but there is no correlation between the intensity of sensitization or the titre of antibodies, on the one hand, and resistance to infection on the other. A previously normal animal subjected to infection differs essentially from a sensitized and immunized animal during the first few weeks of infection when sensitization and immunity are developing as the result of infection, but subsequently the progress of sensitization and antibody formation measured by the means at our disposal follows for a time the same course in both. Sensitization diminishes and in most instances disappears, whereas the titre of complement fixation remains elevated. When infection pursues a fatal course sensitization permanently disappears, but in animals that proceed toward recovery sensitization measured by injection of tuberculin into the skin repeatedly diminishes, usually to complete disappearance, and then increases in successive waves which tend to diminish in height with recovery from infection. The titre of complement fixation gradually diminishes with recovery from infection. It is probable that the skin test for sensitization and complement fixation applied to the blood serum measure antibodies or other factors determining sensitization and immunity that are in excess of those actively concerned in the maintenance of resistance.—*Sensitization and Antibody Formation with Increased Resistance to Tuberculous Infection Induced by Heat-Killed Tubercle Bacilli, J. Freund & E. L. Opie, J. Exper. Med., August, 1938, lxviii, 273.*—(*J. S. W.*)

Effect of Age on Resistance to Tuberculosis.—Resistance to tuberculosis, as measured by survival time of guinea pigs after intracerebral inoculation, varies with age. Young animals are the more resistant, and susceptibility increases progressively with age.—*Effect of Age of the Host on Resistance to Tuberculous Infection, K. C. Smithburn, Proc. Soc. Exper. Biol. & Med., May, 1938, xxxviii, 575.*—(*F. B. S.*)

Nature of Inherited Natural Resistance.—Rabbits belonging to families of demonstrated varying resistance to natural contagion with tuberculosis were studied. The results suggest that there is more or less relationship between resistance and the following factors. Those belonging to the most resistant family, as shown by the longest survival time after a standard infection, exhibited in general (*1*) the lowest degree of permeability of the skin to India ink, (*2*) the smallest extent of primary inflammatory response to heat-killed tubercle bacilli, (*3*) the greatest degree of inflammatory response to tuberculin after maximum sensitization with heat-killed tubercle bacilli, (*4*) the greatest degree of inflammatory response to tuberculin

at the height of allergy of infection, (*5*) the slowest development of lesion at the portal of entry, and (*6*) the greatest rapidity and amount of healing of the lesion at the portal of entry. It is evident that there is no one factor which by itself determines resistance, but that it is the interplay of many factors.—*Nature of Inherited Natural Resistance to Tuberculosis, M. B. Lurie, Proc. Soc. Exper. Biol. & Med., October, 1938, xxxix, 181.—(F. B. S.)*

Rôle of Inherited Natural Resistance.—By inbreeding rabbits for four to five generations, families were developed which exhibited varying, inherited specific resistance to tuberculosis. This was determined by experiments on natural contagion, and also by inoculation of standard quantities of tubercle bacilli intracutaneously and intravenously. In all experiments the families fell into the same order according to resistance. The most suspectible animals developed, as a result of natural contact, a disease of short duration analogous to infantile tuberculosis. Animals with greater resistance developed a disease of longer duration analogous to the so-called childhood type, and the most resistant animals developed a disease of much greater chronicity with the distinguishing characteristics of a reinfection.—*Rôle of Inherited Natural Resistance to Tuberculosis, M. B. Lurie, Proc. Soc. Exper. Biol. & Med., October, 1938, xxxix, 176.—(F. B. S.)*

Tuberculosis in Allergic and Desensitized Guinea Pigs.—It is generally accepted that animals (guinea pigs) rendered allergic by infection with tubercle bacilli of low virulence are protected to a certain degree against subsequent infection with fully virulent microörganisms. That allergy is essential to this partial immunity has recently been questioned. Rich, Cummings and Delahant have reported that guinea pigs, completely desensitized with tuberculin, were found to withstand subsequent virulent infection as successfully as the animals left in the allergic state. From the knowledge gained in some recent experiments the present authors now feel that the above mentioned investigations are inconclusive and do not present the complete picture of the relation between allergy and immunity because the experiments were terminated too soon. In no instance were the experimental animals allowed to live more than sixty-five days after the virulent infection. For the authors' experiments desensitized animals of two different types were available for study: (*1*) allergic-desensitized, that is, guinea pigs rendered allergic by infection with the R1 strain of tubercle bacilli, desensitized by daily injections of tuberculin and then reinfected with virulent tubercle bacilli; and (*2*) normal-desensitized, that is, normal pigs given Old Tuberculin daily, then infected with virulent bacilli. In both types of animals desensitization was maintained by continuing the daily injections of tuberculin in amounts of 1 cc. or more, the amount never being greater then 2 cc. daily. For control, two groups were employed: (1) normal controls, that is, guinea pigs normal at the time of the virulent inoculation; and (2) allergic controls, that is, guinea pigs allergic (due to R1 infection) at the time of the virulent inoculation. More than 500 guinea pigs were used in the various experiments. The microörganism used for the virulent inoculation was the authors' "G" strain of human type tubercle bacillus. Relatively large doses (0.3 to 1.0 mg.) were administered subcutaneously. Most of the animals were allowed to live until death occurred, except in two series (see below). During the first two months after virulent infection the findings were essentially similar to those of Rich, Cummings and Delahant. In the desensitized animals the liver and spleen remained relatively normal in gross appearance while the lung showed nothing but miliary foci, usually widely scattered. During the third and fourth months, however, the desensitized animals died from extensive tuberculous pneumonia. In every instance in which the experiment was allowed to continue for six months or longer a 100 per cent mortality was observed in the desensitized animals long before all of the allergic control pigs had died. Yet even in these desensitized animals whose lungs were completely hepatized by tuberculous pneumonia, the liver and spleen were usually devoid of tuberculosis. The predilection of tubercle bacilli for the guinea pig spleen is well known, nevertheless, in the desensitized animals the "normal" picture was reversed, the lung having become the seat of extensive disease while the liver and spleen were spared. To further examine this phenomenon a histological study was made of tissues from the lungs, liver, spleen and kidneys of animals in all of the series. In two groups of animals mentioned above the guinea pigs were sacrificed at biweekly intervals for a period of ten weeks in order to determine by culture the number of tubercle bacilli in the spleen of each animal. The allergic animals showed the smallest count, averaging less than 5,000 bacilli per spleen. The allergic desensitized came next with approximately 100,000 bacilli per spleen, while the normal controls averaged more than a million bacilli per spleen. His-

tologically the lungs of the control animals showed the usual tuberculous nodules. During the later months of infection areas of bronchopneumonia were present in some animals. Early in the second month of infection miliary lesions were found in the lungs of the normal-desensitized animals and similar lesions in the allergic-desensitized pigs during the third or fourth month. Large areas of bronchopneumonia developed sooner or later and at death the desensitized animals all showed distended lungs, firm and dotted with large areas of bronchopneumonia. Histologically these areas proved to be largely interstitial in nature. Stains showed numerous tubercle bacilli present and, in the bronchial plugs, the bacilli appeared in great clumps as though there the microörganism had found ideal conditions for growth. The bacilli were so plentiful that they could be readily detected with impression smears made directly from the cut surface of the fresh lung. The large number of tubercle bacilli in the desensitized lungs is more striking when compared with smears from control pigs. Even though the lungs of the latter animals were dotted with tubercles, a tedious search of sections or smears may reveal no acid-fast microorganisms whatsoever or, at most, only an occasional bacillus. The livers of the control animals showed the usual rather extensive infiltration, but in the desensitized animals this organ appeared free from tubercles in gross. It was flabby in consistence and smaller in size than the liver of a comparable control animal. Histological sections showed no tubercles or tuberculous tissue. In the normal control animals the spleens showed extensive tuberculosis. Spleens of the allergic controls showed definitely less tuberculosis. In the desensitized animals, however, the spleens remained almost normal in size and exhibited no gross evidence of tubercle formation. Microscopically the controls showed almost complete replacement of lymphoid tissue with epithelioid cells whereas in the desensitized animals there was merely a development of perimalpighian fibrosis. Nevertheless, in spite of the absence of gross or microscopical tubercles in the desensitized spleens, bacteriological studies revealed the presence of large numbers of tubercle bacilli. No tubercles were found in the kidneys of either control or desensitized animals. In the majority of animals of both types sections of the kidney revealed small cortical scars. These were seen to involve mostly the glomeruli. In many of the desensitized animals the convoluted tubules were also extensively damaged. In both control and desensitized animals vascular lesions were frequently noted. These commonly involved the pulmonary artery and portal vein. In the histological picture of the two groups the most pronounced difference is found in the lung where the tubercle of the control animal, a more or less circumscribed accumulation of cells, gives way in the desensitized animal to an interstitial pneumonia which comes to involve a major portion of the entire lung. An even more striking difference exists in the relative number of acid-fast organisms, very difficult to find in the lungs of the control pigs, but innumerable in smears and sections of desensitized lungs. It is suggested that, in the lungs of the desensitized guinea pigs the tubercle bacilli, relieved of the restraining influence of allergy (and immunity), exhibit a phase of free and unrestrained growth comparable to the free growth which is found in the omentum of the newly inoculated nonallergic guinea pig. (Three plates accompany the article.)—*Tuberculosis in Allergic and Desensitized Guinea Pigs. A Study of Histological Changes, H. S. Willis & C. E. Woodruff, Am. J. Path., May, 1938, xiv, 337.—(J. S. W.)*

Tuberculin Allergy without Infection.—This study advances the thesis that tuberculophosphatide has the power to enhance sensitization to tuberculoprotein. Every effort was made to free the phosphatide from any contaminating dead bacilli containing protein and it was felt that this was accomplished inasmuch as large doses of this material failed to sensitize guinea pigs to tuberculoprotein. In the experimental work on guinea pigs the following tuberculoproteins were employed, MA-100 and TPA. The animals were sensitized by repeated intracutaneous doses of the proteins alone and combined with the phosphatide and tested with 0.1 mg. of MA-100 a week after the last dose. The addition of the phosphatide resulted in a definite increase in the antigenic powers of the proteins. The addition of the phosphatide to SOTT and PPD also rendered them good antigens. The value of the phosphatide in enhancing the formation of tubercle-like masses of epithelioid cells is discussed and the correlation between this increase and the more rapid and effective sensitization stressed. The authors' conclusions follow: (*1*) Guinea pigs can be rendered hypersensitive to tuberculoprotein by small, repeated, intradermal injections of active tuberculo-protein. (*2*) The addition of tuberculo-phosphatide to the protein speeds up the process of sensitization and enhances it so that the reactions become indurated and necrotic, closely simulating those of the disease.

(*3*) Active tuberculo-proteins induce a new formation of monocytes and some epithelioid cells. The addition of phosphatide to the protein brings about a massive formation of epithelioid cells. (*4*) With the increased cellular reaction to the mixed injections may be correlated the increase in the speed and intensity of the sensitization. (*5*) The intradermal route is the best for these sensitizations, probably because it provides the greatest dose per cell of the sensitizing agent. (*6*) The degree of sensitization artificially obtainable by the synergistic action of tuberculo-phosphatide and tuberculo-protein is quite comparable to the degree of sensitization naturally occurring in tuberculous animals; moreover, this degree of sensitization may be induced with amounts of the materials from the bacilli which could conceivably be present in the tissues of an infected host.—*Tubercular Allergy without Infection (with two plates), F. R. Sabin & A. L. Joyner, J. Exper. Med., November, 1938, lxviii, 659.*—(*J. S. W.*)

Prevention of Hypersensitivity in Experimental Tuberculosis.—A recent investigation indicates that hypersensitivity and immunity in tuberculosis can be separated. Animals sensitized and immunized with attenuated tubercle bacilli were desensitized by the daily injection of tuberculin. Animals so maintained in a continuous state of desensitization apparently withstood infection with virulent bacilli with an unimpaired immunity. In the present study an attempt was made to determine the extent and character of the lesions in infected animals that were prevented from ever developing hypersensitivity. In the first experiment 16 guinea pigs were used. Eight were given ten daily subcutaneous injections of 1 cc. of undiluted OT made from cultures of virulent organisms grown on Proskauer and Beck's synthetic medium. After this, 2 cc. of the so-called OT were given each day until the death of the animal. This was sufficient to keep the animals desensitized. On the fourth day of the tuberculin treatment all 16 animals were infected with 0.1 cc. of a suspension of virulent tubercle bacilli containing from 5 to 6 organisms per oil-immersion field. Results are given in tabular form. The length of life of this series ranged from twenty-two to forty-two days. Five treated and 4 controls lived into the fourth week, while 3 treated and 4 controls lived forty-two days. At autopsy, which was very complete including many microscopical sections, no appreciable differences were found in the treated and control animals dying in the fourth week. However, the treated animals coming to autopsy in the sixth week showed the lungs, when examined microscopically, to be teeming with acid-fast organisms whereas no such picture was present in the 4 control animals. The livers and spleens of both groups showed about the same degree of caseation, with relatively few bacilli present. In the experiments described by Willis and Woodruff similar lesions containing many bacilli occurred in the tuberculin-treated animals and their severity was attributed to the absence of hypersensitivity. Since the controls in both Willis and Woodruff's experiments and those in the series just described received no treatment at all, a second series of animals was used to control the factor of daily trauma by giving the animals, which did not receive tuberculin, control injections of other fluids. This series consisted of 61 animals that lived over five weeks. All were infected with 0.1 cc. of a suspension of virulent tubercle bacilli containing 20 organisms per oil-immersion field, approximately three times the dose that series I received. Treatment was begun on the day of injection. Eighteen animals received daily injections of the so-called OT, or a similar preparation, one-half receiving 1 cc. daily and the balance receiving 1 cc. at the start, but after the second week 2 cc. daily. Twenty-one animals received daily injections of 10 per cent glycerine in salt solution after the manner of the tuberculin treated group. This was to serve as a control for the glycerine estimated to be present in the tuberculin used. The remaining animals received daily injections of 0.9 per cent sodium chloride, some receiving 1 cc. throughout the experiment, in others the dose being shortly increased to 2 cc. daily. There was no untreated control group. All animals were tested intracutaneously, several times with tuberculin and twice with suspensions of heat-killed tubercle bacilli. A few were tested with live bacilli. The tuberculin treated group gave no positive reactions while the control groups reacted to both tuberculin and bacilli. Results are also reported in tabular form. Although the infecting dose was apparently greater, the length of life in this group ranged from thirty-six to sixty-five days. The severity of the lesions varied widely. In about one-third of all the animals in this series the lungs showed decidedly more tuberculosis than the liver or spleen. This heavier involvement of the lung was not limited to the nonhypersensitive group, it occurred in the glycerine treated and saline treated (hypersensitive) groups as well. Lesions containing enormous numbers of tubercle bacilli were found in 39 per cent of the tuberculin treated group, 28 per cent

of the glycerine treated animals, and in 13 per cent of the saline controls. From this it is evident that the absence of hypersensitiveness cannot be regarded as the explanation of the excessive growth of the bacilli. The duration of treatment was not necessarily found to be the decisive factor in the development of the lesion, for it occurred as early as the sixth week in both an OT and a glycerine treated animal and in animals surviving longest it did not appear at all. The excessive growth occurred twice as frequently in the animals receiving the larger amounts of OT, glycerine or saline in comparison with the ones receiving the smaller dosage. This suggests that the daily trauma may have some influence on the occurrence of the lesion. It is concluded that lack of hypersensitiveness does not play a rôle in the development of these experimental pulmonary lesions which are characterized by an extraordinary proliferation of acid-fast bacilli.—*The Effect of Preventing the Development of Hypersensitivity in Experimental Tuberculosis, R. H. Follis, Jr., Bull. Johns Hopkins Hosp., November, 1938, lxiii, 283.*—(*J. S. W.*)

Allergic Reactions with Various Acid-fast Bacilli.—Rabbits were sensitized by a subcutaneous injection of 2 cc. of bacillary suspensions made by growing *B. leprae* chrome (Duval), *B. leprae* nonchrome (Kedrowski), *B. tuberculosis* human type and *B. smegmatis* (Moeller) on glycerin agar slants, suspending the growth in saline, diluting so that 1 cc. contained one billion bacilli, and then autoclaving at 1 atmosphere pressure for fifteen minutes. Twenty-one days after this sensitizing dose 0.04 cc. of the four allergens was injected endermally. Within forty-eight hours markedly elevated and reddened nodules, with some degree of relative specificity, developed in these areas. Even with dilutions of the allergens to 1:100 and 1:1000, reactions with evidence of specificity occurred.—*Observations upon Allergic Reactions Produced with Various Bacilli of the Acid-Fast Group, W. H. Harris & H. J. Schattenberg, Proc. Soc. Exper. Biol. & Med., October, 1938, xxxix, 122.*—(*F. B. S.*)

Standardization of Diluted Tuberculin.—Large guinea pigs (700 to 1,400 g.) are sensitized by injecting into the groin 0.5 mg. of H37 tubercle bacillus, made into homogeneous suspension by triturating with warm liquefied gelatin and phosphate buffer of pH 7.2–7.4. Such guinea pigs are sufficiently sensitive in four weeks to react to the intracutaneous injection of 0.1 cc. of 1:10,000 dilution of International Standard OT. The standardization test is made by injecting three series of dilutions in varying order across the backs of 3 guinea pigs. The series of dilutions, for example, would be (*1*) 1:10,000, 1:20,000, 1:40,000 and 1:80,000 of the standard tuberculin, (*2*) a series of 80 per cent of these values, that is, 1:12,500, 1:25,000, 1:50,000 and 1:100,000, (*3*) a series of the unknown tuberculin similar to (*1*). Reactions are read at twenty-four and forty-eight hours, and determined to be 100 per cent, 80 to 100 per cent or less than 80 per cent of the standard. The actual loss of potency can be estimated correctly within 20 per cent if such series of dilutions are compared, whereas multiple injections of a single dilution may give reactions, varying as much as 40 per cent in size.—*The Standardization of Diluted Tuberculin, W. E. Bunney & R. Y. Gottschall, Proc. Soc. Exper. Biol. & Med., October, 1938, xxxix, 71.*—(*F. B. S.*)

New Tuberculin Patch Test.—The tuberculin patch test of Vollmer was tried on 96 persons, 91 of whom were children in a tuberculosis sanatorium. Ninety showed conformity between the patch test and the Mantoux test in a 1:1000 solution. The remaining 6 showed positive patch test and negative Mantoux test. The patch test was found to be as reliable as the Mantoux test. Equally good results were obtained with patch tests prepared from old beef extract medium and with synthetic medium from Seibert's formula.—*The New Tuberculin Patch Test, W. D. Stewart, J. Pediat., October, 1938, xiii,* 510.—(*M. B.*)

Immunological Types of Tuberculin Reactors.—All negative reactors to tuberculin cannot be classed together, if their previous course is known. There are persistently negative reactors who from infancy may fail to react to large doses of tuberculin in spite of having had continuous contact with sputum-positive tuberculosis. It is concluded that a highly efficient inherent immunity protects them. Formerly positive reactors may lose allergy eventually, and data on 80 such patients have been published by the same author. Spontaneous desensitization was in most instances quite rapid and in many cases occurred in spite of continuous exposure. It is unusual for such persons to succumb to tuberculosis, for they have an immunity sufficiently potent to protect against the disease and to eradicate primary infection early. It is fairly frequent for tuberculoallergy to reappear. Negative reactors may have a low immunity, subsequently developing tuberculosis of a severe type. There are individuals who are nega-

tive to low doses of tuberculin but who react to higher doses. These are only pseudo-negatives. They are usually endowed with a fairly potent immunity but should not be regarded as so highly immune as persons falling into the first group. The great majority of negative reactors remain negative for a short time becoming eventually positive and yet remaining immune to actual disease. It is suggested that the negative phase of the tuberculin record is due to a natural immunity which prevents primary infection for a time, and that immunity persists through the positive phase of the tuberculin record because acquired immunity is built up. The rôle of primary infection in pathogenesis of tuberculous disease is discussed. It is suggested that active lesions are present continuously from the time of infection in more cases than is usually appreciated with infrequent X-ray examinations. From time to time one encounters positive tuberculin reactors who have been very carefully followed over a period of years without showing disease at any time. Their eventual break-down, if it occurs, should be attributed to fresh exposure more often than to endogenous sources.—*Immunological Characteristics of Different Types of Tuberculin Reactors, M. Paretzky, Arch. Pediat., June, 1938, lv, 352.*—(*M. B.*)

Anaphylaxis to Tuberculoproteins.—In order to study the hypersensitivity that the protein constituents of tubercle bacilli bring about in guinea pigs and the relations which exist between this particular form of the reactivity with the allergy, an attempt was made to provoke a gradual desensitization to the tuberculin proteins in animals sensitized with repeated injections of these substances. Ten guinea pigs were desensitized by one or several subcutaneous injections of bacillary proteins. All the animals showed an intense skin reaction to 0.005 cc. of the same substance. They were then given intracutaneously on ten successive days 0.3 cc. of a solution of the same antigen in a dilution of 5:1000. All 10 guinea pigs showed an intense haemorrhagic reaction, usually followed by the formation of necrotic zones. The desensitization of guinea pigs sensitized to the bacillary proteins was not obtained in this instance, in the manner of anaphylactic reactions to serum. On the contrary the antigen injections augmented the sensitivity. The reactions presented all the characteristics of anaphylactic reactions but with an intensity particularly marked. In a second series of experiments ten guinea pigs made hypersensitive to the bacillary proteins were tested with tuberculin. From ten to fifteen minutes following the intracutaneous injection of the tuberculin an oedematous patch appeared which sometimes became haemorrhagic, rapidly reached its maximum and after several hours began to disappear. It was thus shown that it was possible to provoke positive skin reactions to tuberculin in guinea pigs sensitized to the bacillary protein. But these reactions did not produce the typical tuberculin reaction but appeared to be anaphylactic reactions. Contrary to what had been observed in tuberculous guinea pigs, treated by tuberculin, the injections of a bacillary protein antigen into guinea pigs already anaphylactic to these substances had the effect of augmenting the specific reaction.—*Sur la sensibilité anaphylactique conférée au cobaye par les protéides du bacille de Koch, L. Scalfi, Compt. rend. Soc. de biol., May 14, 1938, cxxviii, 142.*—(*M. T. W.*)

Antigens in Tuberculosis and Cancer.—Dmochowski reported that alcoholic extracts of human organs such as the liver, spleen and kidney, from individuals suffering from tuberculosis or chronic suppurative processes, react in the complement fixation tests with sera of rabbits immunized against bovine caseous tissue. This occurs in the absence of any macroscopical tuberculous or purulent processes in these organs. The present authors examined the tissues from 99 autopsies both serologically and microscopically. Their serological studies confirmed the above noted antigenic relationship of alcoholic extracts of organs to caseous tissue in the case of organs derived from cases of ulcerative pulmonary phthisis, suppurative processes and cancer. However, if the organs were derived from autopsies of patients with circulatory disturbances or chronic nonsuppurative disease, they rarely reacted with sera directed against caseous tissue. The organs, the alcoholic extracts of which reacted with these sera, exhibited fatty degeneration and atrophy microscopically. This was especially conspicuous in the liver. Since no inflammatory changes were noted in these tissues, and since such antigens occur in kidneys that have undergone experimental necrosis, the authors conclude that these "pus antigens" develop in tissues that undergo death in the living animal body.—*Über die Grundlagen der serologisch fassbaren Veränderungen in den Organen beim Krebs und bei der Tuberkulose, L. Dmochowski & A. Pruszczyński, Ztschr. f. Immunitätsforsch, July, 1938, xciii, 331.*—(*M. B. L.*)

Postmortem Serological Tests for Tuberculosis.—The sera from 191 autop-

sied bodies were examined for tuberculosis antibodies by the Haag and Niggemeyer flocculation reaction and by Meinicke's sedimentation technique. In 132 instances without demonstrable tuberculosis 18 and 10.4 per cent respectively gave positive results with these two tests. Some of these cases had been exposed to tuberculous contagion for a considerable time before death, so that one may assume that tuberculosis antibodies had developed in their sera even though no active disease had taken root. Blood sera from inactive tuberculosis were, as a rule, negative in both tests. Often, when the flocculation test was strongly positive, Meinicke's clearing test remained negative. Blood from cases of active tuberculosis usually gave positive reactions in the presence of isolated organ phthisis. Most of the negative results with this blood were in instances of haematogenous dissemination. In the last stages of chronic organ phthisis the reaction was also negative. These tests do not differentiate syphilitic from tuberculous sera.—*Serologische Tuberkuloseuntersuchungen am Leichenblut, L. Dibbelt, Ztschr. f. Immunitätsforsch, August, 1938 xciii, 415.*—(*M. B. L.*)

Tuberculosis Immune Serum and Antigen.—As previously reported, in the reaction with a constant dose of tubercle antigen, a linear relation was observed between complement and tuberculosis immune serum. Additional information was needed, however, regarding the quantitative relations between serum, antigen and complement over a wider range of quantities of each reagent. The results of these investigations are recorded in the present somewhat technical report. In this study "the changes in the haemolytic activity of the complement, as they occur under the different conditions of the test, are determined by comparing the amounts of complement required for 50 per cent haemolysis under different experimental conditions. Thus the measurement that is made is not of the amount of complement fixed, but merely of the change in its haemolytic activity, irrespective of any assumption with regard to the mechanism involved." The effect of antigen on the quantitative relations between immune serum and complement, the effect of immune serum upon the quantitative relations between antigen and complement and the quantitative relations between antigen and immune serum were considered. The authors' summary follows: In experiments covering a wide range of concentration of complement, there was a linear relation, on the one hand, between complement and immune serum when antigen was present in sufficient amount to give the maximal reaction obtainable with the quantities of serum tested and, on the other hand, between antigen and complement when immune serum was present in sufficient amount to give the maximal reaction with quantities of antigen tested. By determining the ratios of the slopes of the straight-line graphs representing these relationships, constant values for the specific relative capacity of antigen with immune serum were obtained. The normal horse serum used in diluting the immune serum had no appreciable effect upon the results. Comparisons of complement activity were made in relation to the point of 50 per cent haemolysis because the form of the haemolytic curve may vary with experimental conditions which necessitate different volumes of complement, without, however, appreciably affecting the region near 50 per cent haemolysis. The 50 per cent point may be determined by interpolation. These quantitative studies provide a basis for the accurate determination of the activity of immune serum and antigen in relation to each other and to complement and appear to be applicable both to experimental studies of the reactions of immune sera and antigens and to the development of practical tests for the diagnosis of disease.—*Quantitative Studies of the Reaction of Complement Fixation with Tuberculous Immune Serum and Antigen, A. Wadsworth, F. Maltaner & E. Maltaner, J. Immunol., August, 1938, xxxv, 93.*—(*J. S. W.*)

Complement Fixation in Experimental Tuberculosis.—From a review of the literature it is concluded that while this serological test is of some value in differential diagnosis its prognostic significance is still uncertain. Further investigation of this problem may aid in unravelling the intricate relations of the mechanism of immunity in tuberculosis. An attempt was made to correlate the serological reactions according to Witebsky, Klingenstein and Kuhn, Beller and Meinicke with the incidence of tuberculous lesions in rabbits. Out of 18 rabbits that were infected with virulent bovine tubercle bacilli for the first time, there was complete agreement between the existence of tuberculous lesion and positive serological reaction in all the three tests in 12 animals. The remaining 6 animals with extensive tuberculosis showed complement fixation in one or more of the three tests. Of 82 rabbits that were reinfected with virulent bovine tubercle bacilli after preliminary immunization with avirulent organisms, two reacted negativey in all the three tests although they had extensive tuberculous lesions. The remaining animals

gave positive complement fixation with at least one of the three tests. Of 30 rabbits immunized with avirulent bovine tubercle bacilli and not reinfected, 26 gave positive complement fixation tests in the absence of gross tuberculous lesions. A positive complement fixation test, therefore, depends on the interaction of tubercle bacilli with the tissues; specific lesions are not essential for its appearance. As to the relative efficacy of the three tests, the Meinicke gave the greatest number of positive reactions. There was an agreement in the outcome of the three tests in 52 to 66 per cent of the rabbits.—*Die Tuberkulosereaktionen bei experimenteller Lungentuberkulose, H. Eickhoff, Ztschr. f. Immunitätsforsch., February, 1938, xcii, 101.*—(*M. B. L.*)

Sedimentation Test in Pulmonary Tuberculosis.—The sedimentation test in a series of 100 pulmonary tuberculosis patients was found to be consistent with the extent and seriousness of the disease as well as with the degree of activity and of potential development. While as a whole there was consistency between the sedimentation rate and the radiological findings, several cases showed considerable discrepancies. This was assumed to prove the superiority of the sedimentation test as a means of disclosing activity and progression. Prognosis and therapy profit widely from this test. This could be seen in cases where collapse therapy, was performed and where with satisfactory collapse the sedimentation rate returned to normal. On the other hand, sudden rise of the readings indicated bilaterlization spread, pleural involvement or lesion elsewhere. The authors consider a reduction of less than 3 or 4 during collapse therapy as not satisfactory and as warning to abandon the collapse by pneumothorax. Because clinical and radiological findings may sometimes mask the true state of progression or course of the disease the sedimentation test is superior as a means of revealing occult lesions. Its application as a supplementary laboratory examination is highly recommended.—*La eritrosedimentacion en relacion con la evolucion y el pronostico de la tuberculosis pulmonar del adulto, I. Aranda & F. J. Menendez, Rev. de tuberc. d. Cuba, April 2, 1938, l, 188.*—(*F. G. K.*)

Erythrocyte Sedimentation Rate in Pulmonary Tuberculosis.—There is little unanimity of opinion in the clinical significance of the test, hence Rest presents his data based on 4,867 tests on 944 patients from 1926 to 1935. He has assumed maximum normal value of 10 per cent for males and 15 per cent for females. At the Sanatorium of the Jewish Consumptives' Relief Society in Denver, Colorado, tests were done as a routine procedure on admission and every three months thereafter or more often if indicated by clinical changes. It is noteworthy that in diabetes high blood sugar retards the rate and low blood sugar increases it. *Conclusions*: The erythrocyte sedimentation test has no diagnostic value whatsoever. Nearly one quarter of demonstrable cases of pulmonary tuberculosis showed normal rates over long periods. The rate is of no value in diagnosing the extent of the lesion. Longstanding fibrocavernous cases, about stationary, rarely showed increased sedimentation rate. In a small number of patients activity coexisted with normal sedimentation. Usually, however, acceleration occurs sooner or later. Acceleration of sedimentation rate strongly suggests active progressive disease and severe damage. The highest rates occur with progressive cavitation or acute exudative forms. Occasionally high sedimentation occurred with little evidence of clinical activity but usually foreshadowed reactivation or progression. Slowing of the rate or a return to normal is a usual accompaniment of clinical improvement and subsidence of toxaemia. The change is significant in relation to prescribing rest or exercise. Cases treated by collapse therapy show the same changes as others to an even more marked degree. As an indicator of activity the clinical picture is generally more reliable. The value in prognosis is probably most significant.—*The Erythrocyte Sedimentation Rate in Pulmonary Tuberculosis, A. Rest, Tubercle, April, 1938, xix, 307.*—(*A. P.*)

Cevitamic Acid.—Normal young adults on a presumably normal diet will excrete varying amounts of vitamin C daily. The excretion of vitamin C following intravenous injection of a test dose of 100 mg. can serve as an index of whether or not the subject is deficient in vitamin C. If more than 70 per cent of the injected vitamin is excreted in three hours, one may infer that the individual is well saturated with the vitamin. In 22 cases with scurvy, administration of cevitamic acid improved the clinical symptoms in all cases. The urinary excretion of vitamin C following a test dose of 100 mg. of cevitamic acid will serve as an index of vitamin C deficiency and as a guide to show the degree of saturation of the tissues following the feeding of cevitamic acid.—*The Response to the Feeding of Cevitamic Acid in Normal and Deficient Subjects as Measured by a Vitamin C Excretory Test,*

Elaine P. Rolli, Ann. Int. Med., May, 1938, xi, 1996.—(A. A. E.)

Blood Picture in Tuberculosis of Bones and Joints.—Studies of the leucocytes in 100 cases of tuberculous bone and joint diseases have shown that the blood picture on the whole is consistent with the progress of the disease in the same way as in pulmonary tuberculosis. The changes, however, appear more slowly; they precede the changes of the blood sedimentation rate and fluctuations in the blood picture proceed more rapidly. The findings seem to confirm the superiority of the leucocytic reaction to the sedimentation test. A few cases have been observed where the leucocytic picture showed definite changes before the diagnosis of tuberculosis could be established by clinical methods. The changes in the blood picture, being to some extent different from those in other surgical conditions such as focal sepsis, hypertrophic arthritis and osteitis fibrosa, help further the differential diagnosis in cases of surgical tuberculosis.—*Investigations of the Blood Picture in Approximately 100 Patients with Bone and Joint Diseases Chiefly of Tuberculous Nature, C. Greger, Acta orthop. Scandinav., June, 1938, ix, 61.—(F. G. K.)*

Tomograph.—Although almost every organ of the body has now been brought within the scope of the roentgenologist, the chest has always been a particularly difficult problem because of its bony cage, hence the development of tomography or reproduction in layers. We have in the chest a translucent organ, the lung, surrounded by denser parts, for example, ribs, chest wall. Ordinarily harder rays must be used than would be most suitable for pulmonary tissues alone. Further difficulties are created by the presence of blood vessels, bronchi and superimposed alveoli. In 1921 Bocage attempted to make an apparatus to photograph layers of the chest at predetermined depths, free of superimposed shadows. Stereoscopy is of limited aid since isolated vision of different foci can be produced only to a limited degree; also, many people cannot visualize stereoscopically. Bocage, on the other hand, conceived the fundamental idea of photographing sections while coördinating the movement of tube and film around a fixed object. Other, or "wandering" shadows are effaced by the factors of movement and distance from the focal point. However, since movement around two axes is necessary except for very small fields, complications arose, and the apparatus now in use was devised by Grossman and Chaoul, of the X-ray department of the Charité University Clinic in Berlin in 1935. The machine is described. The number of sections to be reproduced is limited only by the depth of the patient's chest but for practical purposes three are usually sufficient, (*1*) ventral, about 7 cm. from the anterior chest wall, (*2*) median, about midway from front to back and (*3*) dorsal, about 7 cm. from the back. In certain cases three additional, premedian, predorsal and postdorsal, at depths of about 2 cm. from the main sections, are added. A number of photographic reproductions of roentgenographic pictures with the tomograph are included.—*The Use of the Tomograph, J. B. McDougall, Tubercle, November, 1937, xix, 49.—(A. P.)*

Collective Roentgenography.—Collective roentgenphotography or fluorography is the technical combination of a movie camera, the fluoroscopic screen and the roentgen tube. For over two decades it has been the aim of roentgenologists, physicists and clinicians to combine the advantages of a moving picture with clinical radiology, especially in chest work. Many methods and equipments have been devised but until a few years ago technical accomplishment had not advanced far enough to make a wider use possible. The author reports the results of collective roentgenphotographic examinations of 5,000 patients, the first series of a thorough investigation for tuberculosis planned by the Board of Health of Rio de Janeiro. Clinical and economic considerations show that this method is far less expensive than any other radiographic examination and that it has the advantage of a documentary record which fluoroscopy has not. Roentgenphotography, therefore, may become the preferred method for the examination of large groups of patients in the field of tuberculosis prophylaxis and the author hopes that the example of some European countries as well as that of Brazil will encourage other countries to institute fluorography as a method of greatest social importance.—*Verfahren und Apparatur zur kollektiven Roentgenphotographie (indirekte Roentgenaufnahme), M. de Abreu, Ztschr. f. Tuberk., June, 1938, lxxx, 70.—(F. G. K.)*

Thoracic Serioscopy.—Thoracic serioscopy is described and recommended as a method of study for pleuropulmonary lesions. This procedure consists of taking four stereoscopic roentgenograms under certain specific conditions. The roentgenograms are then studied while superimposed one over the other in the same reviewing box. The different thoracic planes, superimposed from the front backward are successively brought into view by causing them to slide

synchronously one over the other. At the same time one reads on a meter the depth of the planes examined. Serioscopy is of value in that it enables one to visualize and identify lesions of the lung or pleura not clearly brought out by simple roentgenography and automatically gives the distance of the lesion from the chest wall in centimetres, the latter valuable information for the surgeon operating for abscess, tuberculosis cavity or adhesions in pneumothorax cases.—*Thoracic Serioscopy, P. Cottenot, Radiology, July, 1938, xxxi, 1.*—(*G. F. M.*)

The Thorax in the Aged.—One hundred and twenty-five residents of the New York Farm Colony were thoroughly examined by means of roentgenograms, physical examinations, and histories of pulmonary symptomatology. All of these individuals were between fifty and eighty years of age; they were all apparently well and had no specific complaints. In 36 of these patients roentgenograms revealed basilar interstitial changes suggestive of bronchiectasis. In 12 there was localized or diffuse thickening of the pleura; 2 of these had pleural calcification. Emphysema was found in only 10 men. Ten individuals, all without symptoms, had definite tuberculous lesions. Cardiac hypertrophy was found in 34; 21 of these had elevated blood pressures; but none had signs or symptoms of cardiac decompensation. Aortic dilatation was found in 14, each of whom had hypertension and an enlarged heart.—*The Roentgen Findings of the Thorax in the Aged, H. K. Taylor & S. Schwartz, Quart. Bull. Sea View Hosp., April, 1938, iii, 250.*—(*A. A. E.*).

Mediastinal Hernia without Pneumothorax.—Mediastinal herniation occurs through one anterior and two posterior anatomically "weak places": (*1*) just behind the sternum and extending from the first to the third rib, or even to the fifth rib or the diaphragm, (*2*) between the aorta posteriorly and the oesophagus anteriorly and from the level of the fifth to the eleventh thoracic vertebrae, and (*3*) between the third to the fifth thoracic vertebrae and the oesophagus. The two posterior areas are separated by the azygos vein. An upper posterior hernia is mostly above the sternoclavicular joint, while the lower posterior has its upper margin some distance below the clavicles. This differentiates them from an anterior hernia which begins at the level of the first rib. Herniation caused by empyema, being of the pulsion type, is seen best on expiration while the traction type hernias are seen best on full inspiration. Traction hernias may be caused by anything which diminishes the volume of one lung, but pulmonary tuberculosis with its resultant fibrosis and atelectasis, or the incomplete reëxpansion of the lung following pneumothorax, is the most common cause. Roentgenography is almost the sole means of diagnosis and since the hernia usually overlies the dense opposite lung, stereoscopic roentgenograms with the Potter-Bucky diaphragm are invaluable. This technique not only shows the hernia, but, by showing the relation of the pulmonary border to the trachea, helps to differentiate it from mediastinal displacement. In anterior hernias lateral exposures are helpful. Bronchography with iodized oil shows the displaced bronchial tree and in a large anterior hernia the carina is usually rotated, the orifice of the upper lobe bronchus on the invaginated side may have a more posterior position. One patient may have both anterior and posterior hernias. Over 30 cases of mediastinal hernia in the absence of pneumothorax have been observed in the University of Michigan Hospital. Seven of the cases are reported in detail. The majority had tuberculosis and most of them had tuberculous involvement of the bronchi. The herniation itself needs no treatment. Tachycardia and dyspnoea may be overcome when the pull on the opposite lung is relieved, as with thoracoplasty, but this is more likely due to the correction of the torsion and deviation of the mediastinum than because of correcting the herniation. The clinical recognition is important since the hernia may be confused with pulmonary cavity, mediastinal abscess or even bilateral empyema. Herniation of normal lung into the thoracoplasty side may be interpreted as inadequate collapse of the diseased lung. Recognition of a mediastinal hernia will prevent injury to the opposite pleura when intra- and extrapleural procedures for the diseased lung are done.—*Mediastinal Hernia in Absence of Pneumothorax, H. C. Maier, Am. J. Roentgenol., May, 1938, xxxix, 687.*—(*E. M. J.*)

X-ray in Diagnosis of Haemoptysis.—The most common causes of haemoptysis, in the order of their frequency, are: cardiac disease including pulmonary emboli and allied conditions, bronchiectasis, tuberculosis and tumors and ulcerations of the bronchi. Tuberculous ulceration is probably a frequent cause of haemoptysis when the X-ray and physical examinations are negative. With the rapid advance in chest surgery, it has become increasingly important to have an early accurate diagnosis, to determine the exact location of the disease, and to know the extent of the lesion, if malignant, before advising or attempting surgery. Much of

this necessary information comes from the roentgenologist. The author believes that the first step in obtaining the roentgenographic data is a fluoroscopic examination by a competent physician. At this time the movements of the diaphragm, the pulsation of the heart and great vessels, the posterior mediastinum, the presence of any lesions and the changing of the lung shadows with inspiration and expiration are observed. The roentgenologist will also determine at this time the proper roentgenographic examination, remembering that films taken in various positions, during inspiration and expiration, before or after expectoration, and with higher penetration and the Potter-Bucky diaphragm may give more information than the routine stereoscopic films. Pictures to illustrate the types of pulmonary bleeding and the roentgenological procedures making the diagnoses possible are presented.—*Hemoptysis and the Position of Roentgen Examination in Its Diagnosis, Hickey Lecture of 1938, G. W. Holmes, Radiology, August, 1938, xxxi, 131.*—(*G. F. M.*)

Radiology of Haematogenous Pulmonary Diseases.—The differentiation of miliary tuberculosis from carcinomatous infiltration is up to the present time not absolutely possible by radiography. This is more so since in conditions considered as miliary tuberculosis the localization of the foci is uncertain as regards the differential diagnosis. The distinction between these two conditions is quite impossible when both miliary tuberculosis and carcinomatous foci are present in the same patient. The author reports the case of a woman of eighty-four years of age where histological examination following autopsy revealed perivascular dissemination of miliary tuberculosis and of carcinomatous foci. Similar lesions of both types were seen in liver and kidneys together with a solid carcinoma and with epithelioid cell tubercles in the axillary nodes. There was on the roentgen film in the left subhilar region a dense and excessive mottling besides a general blurring and miliary-like appearance of the lung fields. The author therefore concludes that the case probably represents the rupture of a caseous hilar lymph node into the left pulmonary artery while usually following invasion of the larger circulation the miliary spread appears to be less dense and more scarcely disseminated.—*Grenzen röntgenologischer Differentialdiagnostik bei hämatogen entstandenen Lungenerkrankungen, F. H. Weiss, Fortschr. a. d. Geb. d. Rontgenstrahlen, February, 1938, lvii, 92.*—(*F. G. K.*)

Planigraphic Visualization of Intrathoracic Lymph Nodes.—Planigraphic exposures offer the possibility of obtaining exact views of the anatomical relationship of mediastinal and hilar regions. In order to demonstrate the lung fields the usual direction of motion of the pendulum gives the best results, but in order to visualize the central lymph nodes and the region of the bifurcation different movements of the pendulum are more advantageous. By that it is possible to blot out to a large extent the disturbing shadows of the cardiovascular shadows and of the spine. For the visualization of the hilar structures the authors use three exposures of varying sectional planes in each of the two directions of the movement of the pendulum.—*Die Moeglichkeit zur planigraphischen Darstellung der intrathoraka en Lymphdrüsen, C. E. Burger & G. A. von Weel, Fortschr. a. d. Geb. d. Röntgenstrahlen, February, 1938, lvii, 143.*—(*F. G. K.*)

Diagnosis of Invisible Pleural Effusions.—So-called invisible pleural effusions are small pleural effusions of abnormal distribution which are not recognizable on ordinary anteroposterior or posteroanterior roentgenograms of the chest. The authors observed a patient with one such effusion. When seen for the first time the patient exhibited evidence of generalized oedema with bilateral hydrothorax. Diagnostic aspiration of the chest revealed serous fluid bilaterally. Following the diagnostic aspiration, a standard roentgenogram of the chest was taken and revealed clear lung fields and no evidence of fluid. Physical examination of the patient was more informative. Inspection showed nothing of interest but on percussion in the decubitus dorsal position there was a sharp tympanitic note anteriorly from top to bottom, the cardiac dulness was reduced to a small narrow long area, the liver dulness three finger breadths above the costal margin but parasternally it was replaced by tympany as if the lung was interposed at this level between the liver and costal wall. In the sitting position on the left side of the chest there was dulness rising to the nipple, Traube's space was diminished, above this was normal resonance; on the right hepatic dulness was elevated one finger. Percussion of the posterior chest wall in a sitting position gave similar signs. Placing the patient in a "pray to Mohammed" position the basilar dulness disappeared, was replaced by resonance and the apical resonance was changed to dulness. Fremitus was abolished in the area of dulness. Breath sounds disappeared in the area of dulness. There were no abnormal voice sounds. The physical signs, in summary, were those of bilateral hydrothorax. Yet the roentgenogram failed to show fluid. Some authors

have noted that effusions of 400 to 500 cc. may remain concealed in standard roentgenograms. Various positions are necessary to unmask these hidden effusions. The authors found that in lateral decubitus with contralateral distortion and neutral position a roentgenogram may detect an effusion as small as 100 cc. A roentgenogram taken with the authors' patient in dorsal decubitus with a modified Trendelenburg position showed fluid at the apices and laterally. One method used to visualize fluid in the diaphragmatic areas is contrast media such as pneumoperitoneum or iodized oil. The authors used pneumoperitoneum which showed rather sharply in a lateral film the fluid over the diaphragm. These atypical distributions of fluid in the pleural space have been explained as due to many factors including loss of contractility of the lung altering the laws of weight which usually govern the distribution of effusions, the physicochemical peculiarities of the fluid and capillary attractions.—*Du diagnostic clinique et radiologique des épanchements liquides invisibles de la plèvre, J. Dubourdieu & F. G. Capurro, Arch. méd. chir. de l'app. respir., 1938, xiii, no. 2, 98.*—(*J. E. F.*)

Pleural Symphysis.—The presence of a dense, vertical, linear, pleural shadow at the axillary border of the lung, seen on the roentgenogram, is a very good sign of pleural symphysis providing this line is distinct and of sufficient length. In all the cases where verification was possible pleural symphysis was present. This line is almost always associated with other evidences of adherent pleura, particularly obliteration of the costophrenic sinus. The axillary pleural line occupying only one or two interspaces is of less significance although it may indicate localized adhesions. However, when located near the base or middle portion of the axilla these lines nearly always indicate complete symphysis. The linear shadows in the apices lying under the first and second ribs are of no significance. They are found in a large number of roentgenograms where the pleural cavity is not obliterated. The axillary pleural line is not seen in all cases of pleural symphysis. The authors noted its presence in only 20 out of 46 cases. Its presence is conditioned solely by the increased density resulting from the fusion of the two pleural membranes.—*Contribution au diagnostic de la symphyse pleurale, (La ligne pleurale axillaire), A. Dufourt, B. Muller & L. Reynaud, Arch. méd. chir. de l'app. respir., 1938, xiii, no. 1, 53.*—(*J. E. F.*)

Differential Diagnosis between Pleurisy and Empyema.—The normal position of the diaphragm in the resting stage depends upon both the intrathoracic and the intra-abdominal pressure. The former is consistent with the contractive power of the lungs, the latter with the muscular tonus of the diaphragm. Contractive power of the lungs varies considerably under normal and pathological circumstances. It decreases during the expiratory phase, while the pulmonary tissue contracts, and in cases of sero- or pneumothorax. Intraäbdominal pressure is widely influenced by tonus and innervation of the diaphragm, by the condition of the chest and of the abdominal wall, by size and weight of the abdominal contents and by posture. A sufficiently large amount of serous exudate flattens and depresses the diaphragmatic cupola and it increases the respiratory movements of the mediastinum. In cases of basal septic empyema, on the other hand, the diaphragm is ordinarily drawn up as high as the chest wall. This is chiefly due to a toxic paresis of the diaphragm owing to which there occurs also reduction of mediastinal movements. Serous liquid usually shows a concave outline toward the upper lung field while empyema soon becomes encapsulated and thus presents a rather bulging contour toward the pulmonary parenchyma. The author emphasizes the advisability of a paracentesis at a fairly high level. He reports his own mistakes and those of others in cases of misinterpreted localization of shadows cast by basal empyema.—*Zur roentgenologischen Differentialdiagnose zwischen Pleuritis und Empyem nebst einigen wichtigen klinischen Daten, S. Oldberg, Acta radiol. Scandinav., October 31, 1938, xix, 337.*—(*F. G. K.*)

Bronchostenosis.—Bronchostenosis is a very common phenomenon in different pulmonary conditions. Roentgenologically three stages can be distinguished. In the first stage there is a mild atelectasis and hyperaemia; in the second, local emphysema and anaemia occur, and in the third stage obstructive atelectasis with massive pulmonary collapse has developed. The lesions are in close topographical relation to the obstructed bronchus. Between the first and second stage there may be a transitory stage of inspiratory atelectasis and of expiratory emphysema. The anatomical distribution of the bronchi causes the lesions in suitable projections to present wedge-shaped appearance. During the first and second stage the parenchymal area which corresponds to the obstructed bronchus occupies a smaller volume than normal. The wedge-shaped shadows then often assume concave outlines. During the second stage the pulmonary area which corresponds to the obstructed bron-

chus occupies a larger volume than normal and thus the wedge-shaped cleared-up shadows show convex outlines. In advanced cases the changes assume a spherical shape. Since reduction of volume in the first and third stage is more marked during inspiration than during expiration and since the increase of volume in the second stage is greater in expiration than in inspiration, respiratory oscillation of heart and mediastinum will take place in any stage. Bronchostenosis may arise from lesions in the lumen, in the wall, and outside of the wall of the bronchus. The author gives an account of the different pulmonary conditions under which bronchostenosis occurs and discusses the importance of correct interpretation of the roentgen findings. Radiographs should be taken in both, the anteroposterior and the lateral projection, and should be supplemented by bronchography, which is followed by bronchoscopy. Changes in the lumen of the bronchi included obstruction caused by plugs of mucus or pus, of blood and of foreign material. Emphysema and atelectasis that arise from excretional disorders are very transient and run an acute course. In the presence of a foreign body the changes may assume a chronic course unless the obstructive material be found and removed. Lesions of the bronchial wall are caused by inflammatory conditions, such as bronchitis and bronchiectasis, by pneumonia, by bronchial tuberculosis and by cancerous infiltration of the bronchi. Obstructive atelectasis is frequently seen in acute tuberculosis. Thus, most acute infiltrations probably represent obstructive atelectasis. Acute tuberculosis may also begin, however, with local emphysema by complete bronchostenosis having failed to develop and with valvular stenosis having formed instead. Such emphysema will generally pass later into an obstructive atelectasis by the stenosis becoming complete. The finding of such a local emphysema is of great importance for the early diagnosis of tuberculosis. Bronchostenosis of various degrees and of various distribution is a very common finding in chronic tuberculosis. The disappearance of a cavity on the radiograph does not necessarily mean its subsidence but rather points to an aggravation of the condition in that the bronchus leading to the cavity has become occluded by fresh purulent exudate. A rounded cavity varying in size is indicative of stenosis with valvular effect of the bronchus leading to the cavity. Bronchostenosis caused by lesions outside of the bronchus, by which the bronchus becomes compressed wholly or in part, was observed in cases of enlarged lymph nodes, of mediastinal tumors and of aneurysms. Early and correct diagnosis of bronchostenosis may enable earlier and more active therapy to be adopted in a great number of pulmonary conditions.—*On Bronchostenosis, a Roentgenological Study, N. Westermark, Acta radiol. Scandinav., September 30, 1938, xix, 285.*—(*F. G. K.*)

Bronchography following Thoracoplasty.—This paper discusses the findings revealed by bronchography in 13 patients following thoracoplasty. It is well known that it is difficult to determine much from clinical signs in a collapsed lung or, in many cases, from ordinary X-ray films. Hence, lipiodol studies were undertaken, 10 cc. being introduced by the cricothyroid route. More than this tends to overflow into the opposite lung. Considering the restricted mobility of the hemithorax, the absence of lipiodol as early as two weeks after its introduction is noteworthy and indicates that it does not enter the alveoli but flows easily out of the bronchi of the collapsed lung. In 12 out of the 13 cases, one being omitted because of impossibility of getting lipiodol in, 2 showed bronchiectasis, 2 cavity, 3 bronchiectasis and cavity, and 5 were normal. Although bronchiectasis has been mentioned as a frequent concomitant of chronic phthisis, or any extensive pathology associated with pulmonary fibrosis, much tuberculosis literature fails to mention it. It is known that thoracoplasty done for bronchiectasis yields unsatisfactory results. It is suggested that lipiodol roentgenography might be an essential method of investigation before decision as to thoracoplasty.—*Bronchography following Thoracoplasty, H. J. Robinson, Tubercle, October, 1937, xix, 1.*—(*A. P.*)

X-ray Diagnosis of Tuberculosis of Stomach.—The author reports 2 cases of the hypertrophic type of gastric tuberculosis. One of the cases showed evidence of a local gastritis of the canalis part of the stomach with a hazelnut-sized polyp presenting a picture similar to that of a polypoid gastritis. In the second case there was extensive infiltration of the mucous membrane of the main part of the stomach without any appreciable alteration of the gastric peristalsis. The author, after having observed 3 cases of tuberculosis of the stomach, emphasizes the possibility of being able to distinguish the different forms of this rare lesion. From the differential diagnostic standpoint the author feels that the finding of an extensive tumor-like infiltration of the gastric body points to a hypertrophic-tuberculous lesion while an annular extension with softly outlined hourglass stomach, with cuff-shaped infiltration of the mucous membrane, and with demon-

strable defects in this region, speaks in favor of an ulcerative tuberculosis. The roentgenological findings remind one of the picture presented in phlegmonous gastritis.—*Roentgendiagnosis of Tuberculosis of the Stomach, A. Renander, Acta radiolog. Scandinav., December, 1937, xviii, 851.*—(*F. G. K.*)

Tuberculin Patch Test and Mantoux Test.—Of 169 children with active tuberculosis, only one failed to react positively with the tuberculin patch test who reacted positively to the Mantoux test with the stronger solution of the Purified Protein Derivative. Among 118 children admitted to the wards with various diseases, the Mantoux test, even when 1 mg. of Old Tuberculin was used, did not reveal a single case of tuberculous infection which had not already been discovered by the tuberculin patch test.—*Comparative Study of the Tuberculin Patch Test and the Mantoux Intracutaneous Test, H. Vollmer & Esther W. Goldberger, Am. J. Dis. Child., September, 1938, lvi, 584. (Authors' Summary)*—(*M. B.*)

Tuberculin Patch Test.—The author points out the advantages of the tuberculin ointment patch test, and concludes that it may safely be substituted for the Mantoux test in office and public health practice. The ease and speed of application lend the patch test to general use. It overcomes the objection of psychic shock and pain caused by the use of the hypodermic needle. No false positive reactions are encountered, as a control test is an integral part of the method and the skin area is protected as a routine by the adhesive plaster. The ointment is comparatively easy to prepare, is relatively inexpensive and has been found to retain its potency for a period of at least four years. The author's opinion is based on a study of 1,075 tests done on 964 patients ranging in age from three months to fifteen years. These patients were tested simultaneously with the tuberculin ointment and with 0.1 mg. of Old Tuberculin by the Mantoux method. The results of the patch test were in agreement with those of the Mantoux test, in both negative and positive reactors, to the extent of 98.2 per cent. This high percentage of agreement shows the general sensitivity of the patch method. A striking feature is that in no case of a discrepancy in which the ointment method was negative has there been any clinical or roentgenological evidence of active tuberculous disease. On the other hand, the ointment test has been positive in every instance of active tuberculosis. The ointment was prepared in the following manner: Regular tuberculin glycerin broth was inoculated with human tubercle bacilli H37. The cultures were incubated for four weeks and then sterilized, and evaporated to one-fifteenth of its original volume, the organisms being left in the material. The concentrated material was then triturated to a smooth mixture, to which 0.4 per cent phenol was added as preservative. The area usually selected for application is the inner surface of the upper arm or the paravertebral region between the eighth and the eleventh thoracic vertebra. The pea-sized drop of the tuberculin ointment is applied on the right side and a similar sized drop of the control material is placed on the left side. Each of these drops is covered tightly with a one and one-half inch square of ordinary adhesive plaster, which is removed in forty-eight hours. Positive reactions are manifested as follows: a weak test shows a few discrete small papules of a pale rose color; a medium reaction consists of many vividly red papules with erythema of the surrounding skin; while a marked positive reaction shows, in addition to the preceding condition, marked induration and yellowish discoloration of the total test area. —*Further Studies with the Tuberculin Ointment Patch Test, E. Wolff & S. Hurwitz, J. A. M. A., December 18, 1937, cix, 2042.*—(*G. L. L.*)

Sun Bathing in Tuberculosis.—The light and heat of the sun are unquestionably powerful therapeutic agents and must be carefully controlled in their application to tuberculous patients. Sun and light bathing are of most definitely demonstrable value in treating localized lesions of so-called "surgical" tuberculosis. Young people and children and brunettes react best, the very fair-skinned tolerate the sun with difficulty and albinos not at all. Open tuberculous lesions, fistulas and sinuses, often heal remarkably, as do chronic localized infections generally, such as open empyemata, sinuses and ulcers. Among other tuberculous conditions commonly benefited are lupus and tracheobronchial adenitis. Pulmonary tuberculosis is, generally speaking, not responsive to sun treatment, the lesions being usually more or less widely scattered in soft tissues, poorly delimited and liable to reactivation from injudicious exposure, especially if associated with atmospheric heat. Heliotherapy, however, may be tried in cases where there are isolated localized foci, approximating those of surgical tuberculosis, in the absence of fever or other symptoms of activity. Cases of chronic pleurisy with thickening and adhesions may be benefited and absorption facilitated. A good circulation of air about the patient is imperative, especially in pulmonary cases. What is

required is not baking by heat but exposure to light. Not only among ill patients but among holiday makers should indiscriminate sun exposure be avoided. There are authentic cases of activation of latent unsuspected tuberculous lesions, with fever and haemoptysis, following the uncontrolled and ignorant use of sun baths. Undue burning, fatigue, headache and lassitude are symptoms associated with overexposure.—*Sun Bathing in Tuberculosis, Its Use and Abuse, B. Hudson, Tubercle, November, 1937, xix, 72.*—(*A. P.*)

Heliotherapy.—Light therapy, both natural and artificial, is of definite value in the treatment of certain forms of tuberculosis. The clinically effective spectral regions are still to be defined and the mode of action is not known. In tuberculosis, predominantly exudative disease requires extreme caution in being treated with light and in pulmonary lesions represents a contraindication. Beneficial effects from irradiation may be obtained by the action of ultraviolet and infrared rays in tuberculosis of the bones, joints, peritoneum, intestine, lymph nodes and larynx. In tuberculosis of the skin, only lupus vulgaris reacts favorably to light therapy. In tuberculosis of the bones and joints, suitable graded exposure to natural sunlight is an adjuvant to proper surgical treatment. In pulmonary tuberculosis harm may be done by injudicious exposure to sunlight. In the treatment of postoperative tuberculous sinuses and fistulas, light therapy is very useful. Intestinal tuberculosis and tuberculous peritonitis respond particularly well to this form of treatment. It must always be remembered that overdosage may produce harmful focal reactions.—*Heliotherapy of Tuberculosis, E. Mayer, Ann. Int. Med., April, 1938, xi, 1856.*—(*A. A. E.*)

Roentgen and Light Therapy.—The results of roentgen and light irradiation applied to peritoneal and intestinal tuberculosis warrant their more frequent usage. Therefore, the effects on tissue, the indications, the technique of clinical application and the comparative clinical results are presented. Cells vary in susceptibility to X-ray according to a specific range of sensitiveness of each histological variety, the most susceptible being those which are younger and mitotically more active. Lymphoid tissue in the intestinal wall and intraäbdominal lymph nodes respond to X-ray radiation as elsewhere in the body. The mucosa of the small intestine is more sensitive than that of the colon and the duodenal and jejunal mucosa may be irritated by a smaller dosage than is sufficient to produce erythema. Tuberculous enteritis and peritonitis require more X-ray than acute inflammations, the dosage varying between 50 and 80 per cent of the skin tolerance. In skilled hands, with proper equipment, the undesirable effects may be avoided. A dosage smaller than the maximal for tumors is recommended, though a brief trial of tumor dosage of X-ray under careful observation is indicated in proliferative forms of intestinal and peritoneal tuberculosis that have not responded to smaller doses. Best effects are usually obtained by a number of irradiations at three or four-week intervals, though smaller doses may be repeated more frequently. Repeated local X-ray irradiation, plus exposure of the entire body to gradually increasing doses of ultraviolet, natural or artificial radiation may result in slow but complete resolution. The action of radiotherapy and the time required to bring lesions under control depend upon the degree of leucocytic infiltration and the amount of connective tissue and degenerative products. Before offering either X-ray therapy or heliotherapy, the type of intestinal or peritoneal tuberculosis must be known and correlated with the pulmonary lesion. Ulcerative intestinal tuberculosis, the most common form of intestinal tuberculosis, found in from 50 to 80 per cent of autopsies of persons dying with tuberculosis, has been treated by roentgen ray, ultraviolet or the two combined with satisfactory results. However, great caution must be exercised in roentgen therapy of this type and added care must be taken when combined with heliotherapy to avoid burns that would not result when one or the other was used alone. The best results with roentgen ray therapy are obtained in the simple proliferative or hyperplastic type of intestinal tuberculosis. In peritoneal tuberculosis the best results are obtained in the fresh ascitic or exudative form. The plastic type is not so easily influenced, while the caseous type responds only fairly well even when treatment is given over a long period. Both low and high voltage X-rays have been found satisfactory. The authors map out the abdomen into four anterior and posterior fields, a dose of 10 to 15 per cent U.S.D. being applied to one anterior and one posterior field each week. The treatment is continued for six months. Over one degree elevation in temperature requires a decrease in dosage. Smaller doses were given over upper abdominal lesions and in the caseous type. When limited to the lower abdomen a dose of 20 per cent U.S.D. was given once a week over anterior and posterior fields. Heliotherapy is also of definite value in intestinal and peritoneal tuberculosis used alone or in combination with X-ray irradiation. When active intestinal tuberculosis

occurs as a complication of active febrile pulmonary tuberculosis, heliotherapy given regularly for a period of months often has a favorable effect. With heliotherapy and hygienic treatment, including a high vitamin diet, symptoms often disappear in a few months in such cases, but the treatment should be continued for six months to two years after an apparent cure. Patients not responding to light should be given roentgen ray or the two combined. Peritoneal tuberculosis is often greatly improved when heliotherapy is used as an adjunct to other measures. After it has become quiescent the primary focus may be removed surgically. Here again the serous exudative type responds well while the dry proliferative form is more refractory and caseous forms respond very poorly. Pain often disappears rapidly, especially in children.—*Roentgen and Light Therapy of Intestinal and Peritoneal Tuberculosis, E. Mayer & M. Dworkin, Radiology, July, 1938, xxxi, 35.*—(*G. F. M.*)

Codliver Oil Therapy.—Tuberculous skin ulcers produced by intracutaneous injection of tubercle bacilli into guinea pigs healed faster when treated topically with codliver oil than when not treated. Other oils, such as paraffin, lanum, olive and cottonseed (Wesson), were ineffective. Codliver oil was effective when given intramuscularly and subcutaneously, but not when given orally. The active agent was found to be in the nonsaponifiable fraction. Fractionation of this nonsaponifiable residue showed the active substance to be in the vitamin fraction. Tests with halibut-liver, tuna-liver and codliver oil, varying in their proportions of vitamin A and D, did not indicate that vitamins A or D were the essential factors.—*Cod Liver Oil Therapy in Experimental Tuberculosis, H. R. Getz, Proc. Soc. Exper. Biol. & Med., May, 1938, xxxviii, 543.*—(*F. B. S.*)

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